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Indian Standard

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भूकृत्रिम — फुटपाथ कपड़े के रूप में भूवस्त्रादि की स्थापना के लिए दिशानिर्देश

Geosynthetics — Guidelines for Installation of Geotexiles as Pavement Fabric

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Geosynthetics Sectional Committee, TXD 30

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Textile Division Council.

Old and weathered pavements contain transverse and longitudinal cracks that are both temperature and load related. Cracks under overlay rapidly propagate through to new surface, a phenomenon called reflective cracking. These cracks in the pavement surface cause numerous problems, including:

a) Riding discomfort for the users;
b) Reduction of safety;
c) Infiltration of water and subsequent reduction of the bearing capacity of the subgrade;
d) Pumping of soil particles through the cracks; and
e) Progressive degradation of the road structure in the vicinity of the cracks due to stress concentrations.

The method most often used to rehabilitate these pavements is to overlay the pavements with bitumen/asphalt concrete (AC). This temporarily covers the cracks. After the overlay has been placed, any lateral or vertical movement of the pavements at the cracks due to load or thermal effects causes the cracks from the existing pavement to propagate up through the new bitumen/AC overlay (called *reflective cracking*). This movement causes raveling and spalling along the reflective cracks and provides a path for surface water to reach the base and subgrade which decreases the ride quality and accelerates pavement deterioration.

Geosynthetics (geotextiles, geocomposites, geomembranes and geogrids) under the bitumen/AC overlay can provide sufficient tensile strength to relieve stresses exerted by movement of the existing pavement thus acting as a stress relieving interlayer which retards the development of reflective cracks. Impregnation of the geotextile with bitumen provides a degree of moisture protection for the underlying layers. Thus, it also waterproofs pavements that typically allow 30 to 60 percent of precipitation to infiltrate and weaken the road structure. The interlayer can also provide reinforcement when it can contribute significant tensile strength to the overlay system. The reinforcement limits the movement of the cracked old pavement under traffic loads and thermal stress by holding the cracks together.

The benefits of geosynthetic interlayer include:

a) Waterproofing the pavement,
b) Delaying the appearance of reflective cracks,
c) Lengthening the useful life of overlay,
d) Added resistance to fatigue cracking, and
e) Saving up to 50 mm of overlay thickness.

Pavement geotextile fabrics are non-woven polyester or polypropylene fabrics that are field saturated with an asphalt binder and placed as an interlayer beneath a pavement overlay or between pavement layers. When placed, the fabric becomes an integral part of the roadway section, forming a barrier to water infiltration and absorbing stresses to reduce reflective and fatigue cracking of the new pavement surface layer. Non-woven geotextile fabrics are preferred in view of their high elongation and low tensile strength required for stress relief. Paving fabrics made of other products (nylon, glass, combinations of materials) can also be used but they are usually more expensive. Non-woven paving fabrics typically exhibit relatively low modulus and thus can mobilize only limited stress at low strain levels. A thicker fabric results in lower stresses at the tip of a crack than a thinner one and thus the thicker layer is more effective in delaying reflection cracking. The full thickness of the non-woven fabric shall be saturated with asphalt. Clearly, asphalt retention rate is an important property which is directly related to the fabric weight and thickness. Also, a heavier fabric will reduce bleed through during construction and reduce the effect of any damage by construction traffic.

(*Continued to Third Cover*)

Indian Standard

GEOSYNTHETICS — GUIDELINES FOR INSTALLATION OF GEOTEXILES AS PAVEMENT FABRIC

1 SCOPE

1.1 The standard prescribes guidelines for installation of geotextile as pavement fabric.

2 REFERENCE

The standard given below contains provision which, through reference in this text constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

IS No.	*Title*
13321 (Part 1) : 1992	Glossary of terms for geosynthetics : Part 1 Terms used in materials and properties

3 DEFINITIONS

3.1 The definitions given in IS 13321 (Part 1) and the following shall apply.

3.2 Minimum Average Roll Value (MARV) – MARV is the average value of roll minus two standard deviations.

4 SURFACE PREPARATION

4.1 The graded surface shall be dry, thoroughly clean from all dirt, water and oil, smooth and free of obstructions, depressions and debris. The surface on which a moisture barrier interlayer is placed shall have a grade which will drain water off the pavement. Remove all sharp objects and large stones. Cut trees and shrubs flush with the sub-grade. Removal of topsoil and vegetation mat is not necessary, but is recommended where practical. Excessive soft spots or voids may be unsuitable for geosynthetic installation.

4.2 Prior to using geo-textiles to minimize reflective cracks, the existing pavement shall be evaluated to determine pavement distress. The size of the cracks and joints in the existing pavement shall be determined. All cracks and joints larger than 3 mm in width shall be cleaned and sealed with bituminous material or by a method approved by the site engineer. Differential slab movement shall be evaluated, since deflections greater than 0.5 mm cause early reflective cracks. Crack filling material shall be allowed to cure prior to placement of paving fabric. Potholes and other pavement distress areas that are structurally deficient shall be repaired prior to geo-textile installation. Milling of severely cracked and uneven or rutted pavement may be required, or a thin layer of bitumen/asphalt called a leveling course may be applied. Sections of broken bitumen/asphalt that move under traffic loading should be removed down to the sub-grade and reconstructed. A profile correction shall be laid, wherever required, before placing the paving fabric.

5 APPLICATION OF THE TACK COAT

5.1 The geo-textile paving fabric generally laid between two bituminous layers should be used over the entire pavement area affected by cracking and not in the form of strips over the pavement cracks. On existing cement concrete pavements, a layer of dry bitumen/bituminous concrete should be provided before laying the paving fabric.

5.2 Proper installation of the asphalt cement/bituminous tack coat is crucial; mistakes can lead to early failure of the overlay. Uncut paving grade asphalt cements/bitumen shall be used. The grade of the tack coat should be the same as used in the asphalt concrete overlay.

5.3 Minimum air and pavement temperature shall be at least 10°C or more for placement of tack coat. The distributor tank temperature of the tack coat shall not exceed 160°C to avoid damage to fabric and the minimum temperature shall be 140 ± 2°C to permit a uniform spray pattern. For asphalt emulsions, the distributor tank temperature shall be maintained between 55°C to 70°C.

NOTE — Polypropylene begins to melt at a temperature of about 160°C. Therefore, when using polypropylene products, the temperature of the paving mixture should not exceed 150°C when it contacts the geosynthetic.

5.4 Cationic and anionic emulsions may be used successfully provided (a) the paving fabric is laid only after allowing the specified time for curing of emulsion, and (b) no traffic is allowed over the area where tack coat has been applied. However, they shall be applied at a higher rate to offset the water content of the emulsion. Within street intersections, on steep grades or in other zones where vehicle braking is common, the normal application rate shall be reduced by about 20 percent as directed by the engineer. Cutbacks and emulsions containing solvents shall not be used. The tack coat application rate shall be sufficient to saturate the fabric and to bond the fabric to the existing pavement surface.

5.5 The tack coat shall be sprayed uniformly using a calibrated distributor spray bar. The bar shall be adjusted to obtain uniformity and the correct width of spray, usually 5 to 7.5 cm past the edge of the geotextile. The spray of the nozzles should overlap so that uniform double coverage occurs. Heavy spots, streaks or gaps will cause problems in the system. Hand spraying, squeegee and brush application may be used in locations of fabric overlap or places where the distributor truck can not reach. Every effort shall be made to keep hand application to a minimum. The tack coat shall be applied uniformly to the prepared, clean and dry pavement surface.

5.6 The tack coat shall be applied uniformly to the prepared dry pavement surface at the rate governed by the following equation:

$$Q_d = 0.36 + Q_s + Q_c$$

where

Q_d = design tack coat quantity (kg/m^2);

Q_s = saturation content of the geotextile being used (kg/m^2) to be provided by the manufacturer; and

Q_c = correction based on tack coat demand of the existing pavement surface (kg/m^2).

NOTE — The typical values of tack coat demand of existing bituminous pavement surfaces are as under:

Type of Surface	*Quantity of Liquid Bituminous Material* (kg/m^2)
Normal bituminous surface	0.20 – 0.25
Dry and hungry bituminous surface	0.25 – 0.30

5.7 The target width of the tack coat application shall be equal to the paving fabric width plus 150 mm. Tack coat application shall be wide enough to cover the entire width of fabric overlaps. The tack coat shall be applied only as far in advance of paving fabric installation as is appropriate to ensure a tacky surface at the time of paving fabric placement. Traffic shall not be allowed on the tack coat. Any spillage or excess tack coat shall be removed/cleaned from the pavement or sand be sprayed over it.

6 DEPLOYMENT OF GEOTEXTILE PAVING FABRIC

6.1 The geotextile paving fabric shall be placed on a dry surface. In case it rains after installing the paving fabric, but before placing the overlay over it, all excess water should be removed and the fabric should be allowed to dry up sufficiently before placing the overlay.

6.2 Geotextile paving fabric shall be placed with heat set side facing up, onto the tack coat using manual or mechanical laydown equipment capable of providing a smooth installation. In either case, the geotextile shall not be allowed to wrinkle or fold. The paving fabric shall be placed before the tack coat cools and looses its tackiness. Paving fabric shall not be installed in areas where the first lift of overlay asphalt tapers to a minimum compacted thickness of less than 40 mm. Excess paving fabric, which extends beyond the edge of existing pavement or areas of tack coat application, shall be trimmed and removed.

6.3 When the asphalt emulsions are used, the emulsion shall be allowed to cure properly such that essentially no water moisture remains prior to placing the paving fabric.

6.4 Wrinkles severe enough (in excess of 25 mm) to cause folds shall be slit and laid flat. Brooming and/or pneumatic rolling will be required to maximize paving fabric contact with the pavement surface. Additional hand-placed tack coat may be required at overlaps and repairs to satisfy saturation requirements of the fabric, as required by the engineer.

6.5 Unroll the geotextile in the direction of paving operation. Do not drag the geotextile on the ground or mishandle in any way. Successive sheets of geotextiles shall be overlapped a minimum of 50 to 150 mm. The overlap shall be shingled in the direction of the paving operation. Overlaps of adjacent rolls may be 150 mm to accommodate variation between the width of the roadway and paving fabric. Excess fabric shall be cut and removed so that overlaps of adjacent rolls do not exceed 150 mm. Additional tack coat shall be applied to overlaps.

6.6 In case of slopes, place the geotextile with the machine direction oriented up-down. Lap the upper sheets over the lower sheets. When the geotextile is placed on a slope steeper than 6V:1H, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent the slippage and tearing of the geotextile.

6.7 On curves, the geotextile shall be folded or cut to conform to the curves. The overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock.

6.8 In the case of drains, joints or other irregularities, the geotextile shall be placed normally and then cut around the obstruction. Any wrinkles over 25 mm shall be slit open and treated as overlaps.

6.9 Prior to covering, the geotextile shall be inspected by a certified inspector of the engineer to ensure that the geotextile has not been damaged during installation. Damaged geotextile shall be repaired or replaced immediately.

6.10 The fuzzy side of the paving fabric should be laid down into the tack coat leaving the smooth side up.

7 INSTALLATION OF THE OVERLAY

7.1 Installation of the geotextile and the bitumen/ asphalt concrete overlay shall be done on the same day. Paving can commence as soon as the fabric is laid down. After laying the paving fabric, some loose bituminous concrete should be sprinkled on it in the wheel path of the paver and the tipper to ensure that the fabric is not picked up between the wheels.

7.2 Turning of the paver and other vehicles shall be done gradually and kept to a minimum to avoid movement and damage to the paving fabric. Abrupt starts and stops shall be avoided. Damaged fabric shall be removed and replaced with same type of fabric and a tack coat. Unless otherwise approved by the engineer, no traffic except necessary construction traffic shall be allowed to drive on the paving fabric.

7.3 The temperature of the bitumen/asphalt shall be between 130°C to 145°C so as to give enough heat to the bitumen in the tack coat to rise up into the fabric.

7.4 The thickness of the AC overlay shall be determined from the pavement structural requirements. However, the minimum compacted thickness of the first lift of the overlay at its thinnest point shall be 40 mm necessary to produce enough heat to guarantee saturation of the paving fabric and bonding of the pavement layers. In cold weather, a thicker overlay may be necessary to achieve the same objective.

7.5 Bitumen/asphalt can be placed by any convenient means. Compaction should take place immediately after dumping in order to ensure that the different layers are bonded together.

7.6 Excess tack coat that bleeds through the paving fabric shall be removed by spreading sand on the paving fabric. Excess sand shall be removed before beginning the paving operation.

7.7 In the event of rainfall on the paving fabric prior to the placement of the asphalt overlay, the paving fabric shall be allowed to dry before asphalt concrete is placed.

8 PROTECTION OF GEOTEXTILE

8.1 Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff and construction activities. Traffic or construction equipment shall not be permitted directly on the geotextile except as directed.

8.2 During installation, cover the geotextile with specified cover material as soon as possible.

8.3 Place the cover material on the geotextile in such a manner that the geotextile is not torn, punctured or shifted. Use a minimum 150 mm thick cover layer or twice the maximum aggregate size, whichever is thicker.

9 INSPECTION

9.1 The owner or owner's representative may randomly inspect geotextile before, during and after installation.

9.2 Any damaged or defective geotextile (that is frayed coating, separated junctions, separated layers, tears, etc) shall be repaired/replaced in accordance with **10**.

10 DAMAGE REPAIR

10.1 Localized distressed areas of existing AC pavement that are caused by base failure shall be repaired prior to any pavement rehabilitation.

NOTE — Geotextiles are not capable of bridging structurally deficient pavements.

10.2 Rahabilitate localized distressed areas and utility cuts by improving with the application of geotextiles.

10.3 Repair isolated areas that are excessively cracked with geotextile prior to an AC overlay by using either a full-width membrane strip depending on the size of the distressed area.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Geosynthetics Sectional Committee, TX 30

Organization	*Representative(s)*
The Bombay Textile Research Association, Mumbai	Dr A. N. Desai (***Chairman***) Shri V. K. Patil (*Alternate*)
Business Coordination House, New Delhi	Shri Samir Gupta Shrimati Ritika Gupta (*Alternate*)
Central Road Research Institute, New Delhi	Shri Sudhir Mathur Shri Jai Bahagwan (*Alternate*)
Central Soil and Materials Research Station, New Delhi	Shri Nripendra Kumar Shri Manish Gupta (*Alternate*)
CIDCO, Mumbai	Representative
Coir Board, Kochi	Dr U. S. Sarma Shri M. Kumaraswamy Pillay (*Alternate*)
Department of Jute and Fibre Technology, Kolkatta	Dr Swapan Ghosh Shri K. R. Gupta (*Alternate*)
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E. I. Dupont India Pvt Ltd, Gurgaon	Shri R. Ganesh Shrimati Vedika Kapoor (*Alternate*)
Ganga Flood Control Commission, Patna	Shri S. Masood Husain Shri Ravi Bhushan Kumar (*Alternate*)
Garware Wall Ropes Ltd, Pune	Shri Tirumal Kulkarni Shri S. J. Chitnis (*Alternate*)
Gujarat Engineering Research Institute, Vadodara	Shri L. V. Ashara Research Officer (*Alternate)*
Indian Jute Industries' Research Association, Kolkata	Shri P. K. Choudhury Shri Koushik Das (*Alternate*)
Indian Jute Manufacture Association, Kolkatta	Representative
Jaya Shree Textiles, Hooghly	Shri Pawan Sharma
Kusumgar Corporates, Mumbai	Shri Y. K. Kusumgar Dr M. K. Talukdar (*Alternate*)
Macaferri Environmental Solutions Pvt Ltd, Navi Mumbai	Dr Ratnakar Mahajan
Maharashtra Maritime Board, Mumbai	Representative
National Highways Authority of India, New Delhi	Shri R. K. Gandhi Shri R. P. Singh (*Alternate*)
National Jute Board, Kolkatta	Shri T. Sanyal Shri A. K. Khastagir (*Alternate*)
Office of the Textile Commissioner, Mumbai	Shri Ajay Pandit Shri M. Baluchamy (*Alternate*)
Premier Polyfilms Ltd, Ghaziabad	Dr Sanjeev K. Verma Shri Harinder Kumar (*Alternate*)
Reliance Industries Ltd, New Delhi	Shri M. S. Verma Shri V. Ravikanth (*Alternate*)
Strata Geosystems (I) Pvt Ltd, Mumbai	Shri Narendra Dalmia Shri Shahrokh Bagli (*Alternate*)
Supreme Nonwovens Pvt Ltd, Hyderabad	Shri C. K. Chaudhuri Shri C. K. Jain (*Alternate*)
Techfab India, Mumbai	Shri Anant Kanoi Dr Saurabh Vyas (*Alternate*)

Organization	*Representative(s)*
The Synthetics & Art Silk Mills Research Association, Mumbai	Dr Manisha Mathur Shrimati Ashwini Sudam (*Alternate*)
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Member Secretary
Shri J. K. Gupta
Scientist 'C' (TXD), BIS

(*Continued from Second Cover*)

Full-width fabrics shall be limited to use on flexible pavements where there is extensive random cracking and waterproofing of the pavement is needed and justified. If widespread alligator cracking is due to surface aging of bitumen/asphalt and not structural failure, full-width fabric may be an inappropriate treatment; rejuvenation or surface recycling may be more appropriate.

Fabrics have not demonstrated good success in reducing reflection of thermal (transverse) cracks in flexible pavements and joints in concrete pavements. Geogrids typically exhibit much higher moduli than fabrics and logically should take on more stress at low strain levels. Grid systems serve primarily as a reinforcing interlayer. Composites may offer benefits of both fabrics (stress-relieving interlayer) and grids (reinforcement). Composites are recommended for use on pavements where both reinforcement and waterproofing are desired.

Heavy-duty membranes shall serve as both a waterproofing membrane and a stress-relieving interlayer. The mastic membrane shall provide both reduced permeability and be sufficiently soft and thick to act as a stress-relieving interlayer. Membranes are relatively expensive and are normally placed in strips over joints or cracks.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments Issued Since Publication

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